

In Search of New Physics with Atomic Clocks in Space

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Atomic clocks play an important role in defining the boundaries of various theories of physics. In space, the combination of a benign environment that results in higher performance clocks, and a significant deviation from gravity on the surface of Earth, provides a unique opportunity to test some of the most important questions facing the present day physics:

- Are nature's constants really constant, or have they changed over the evolution period of the Universe?
- How can gravity be reconciled with the quantum theory?
- What lies beyond the standard model of fields and particles?

These questions are the subject of some new investigations based on the application of atomic clocks in space. In particular, experiments based on laser cooled cesium and rubidium atoms have been selected by NASA and ESA to fly onboard the International Space Station to extend the clock tests of relativity to new and scientifically interesting regimes. A third experiment, currently under study, is based on a flight of atomic clocks near the sun to search for a variation of fine structure constant with several orders of magnitude sensitivity beyond what is possible on or near Earth. In this talk, the role of space atomic clocks in testing the fundamental laws of physics will be discussed, and relevant details of the ISS experiments, as well as the solar fly-by experiment, will be described.